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ABSTRACT

This paper reports research aimed at understanding how teachers use innovations and suggests that the intentions of teachers, explored through forms of self-report, are an important clue. Eight teachers in three English comprehensive schools participated in a study of their use of the United Kingdom Schools Council Integrated Science Project (SCISP). This project was chosen for study because it asked teachers to take seriously the discussion of value issues in science in the context of integrated subject matter, with an aim of changing student attitudes and evaluating these changes. Interviews, participant observation, and questionnaires were employed to study the use of the project. The teachers also participated in two one-hour clinical interviews in which constructs about their teaching methods were elicited. Analysis of the constructs suggests that teachers construe their practice in such a way as to reduce ambiguities associated with their work. The paper shows how these teachers adapted the innovative materials so as to minimize sources of role diffuseness inherent in the doctrine of the project. The results suggest that the teachers operated functional systems designed to permit stable classroom relationships. (Author/MLF)

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Teacher Constructs and Curriculum Change:

Innovative Doctrines and Practical Dilemmas

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Introduction[1]

Schools have never lacked for images of what they might be. A dominant recent image is one in which schools become centres of inquiry, in which authority stemmed from evidence artfully interpreted rather than from teacher fiat. So, for example, Schwab (1966) urged that science be taught through "invitations to enquiry". The fate of this idea as it subsequently became translated into a variety of relatively unsympathetic instructional systems is an interesting example of how innovative ideas become variants on prevailing practice both in terms of technical fads of the time and in the ultimate domestication in practice.

Innovative ideas like Schwab's tend to become pale reflections of the original as they are implemented in the classroom. There is a growing body of literature which attests to this fact (Carlson, 1965; Hodgetts, 1968; Goodlad, 1970; Heron, 1971; House, 1974; Elliott, 1977; Olson, 1977). Why do innovative ideas suffer the fate they do at the hands of teachers? This is an important question for the sub-field of curriculum change and it is the theme of this paper.

What is it about schools, or teaching or teachers that tends to limit the extent to which new ideas are taken up? I want to follow the suggestion that teachers have to cope with certain unremitting aspects of their job(which tend to limit the extent to which new ideas can be tried out and eventually take root)by first discussing how teachers cope with innovations and following this by reference to a case to illustrate the argument. I start from the suggestion made by Ian Westbury (1973) that "The classroom seriously modulates a conception of teaching derived from images of the tutorial". For Westbury, the fact of a classroom, which I take to be a symbol for particular social relationships that occur when numbers of students are together in one room and required to accomplish some tasks under the leadership of the teacher, restricts what teachers can do; or more importantly, since there is little evidence that teachers want to change what they do, restricts what is reasonable for others to suggest that teachers do. Thus Westbury (1973) finds that what "open" educators propose is likely beyond what teachers can do given the nature of the "classroom". I want to pursue the question of how the "classroom" might modulate conceptions of teaching.

Innovative Doctrines and Practical Dilemmas

To begin with I will assume that how teachers construe their work affects what happens in the classroom. Teachers' intentions matter and these are importantly affected by past experience. One way of finding out more about how teachers see their work is

to talk to them about their experience with an innovative project. I argue, following Lortie (1973), that innovative doctrines, such as those, for example, associated with "open" education, create dilemmas for teachers concerning the value and function of their common practice, and that much can be learned about the meaning of that practice by asking teachers to describe what the dilemmas are and how they are resolved. Lortie calls the meaning attached to common practice the "moss"; an image suggesting slow and unnoticed growth of and firm attachment to the common practices. It is these common practices we need to understand before we can understand what teachers make of innovative doctrines and why these so seldom succeed in becoming "mossy". The study of common practice in the context of the implementation of innovative doctrine has heurisitic value for the researcher. The doctrine points to certain practices to be changed; certain expectations are created and failure to find the expected generates interesting research problems. The emphasis on reform of schools in terms of "open" education has lead to some interesting problems: Goodlad (1970) and his associates, for example, did not find schools using expected teaching innovations, the Berlaks (1975) found supposedly "informal" teachers showing signs of formality, Smith found Geoffrey , teaching through textbook recitation. The expectations set up by thinking that innovative doctrines have taken root have led us to realize specific aspects of these doctrines seem not to be functional in the classroom setting and

hence have stimulated a renewed focus on the nature of that setting. I would argue that we need to ask teachers to tell us why it is so hard to make these aspects of innovative doctrines work, and a good starting point is to raise questions with them about innovations they have tried.

The study reported here follows this advice and is based on case study of three English comprehensive schools with recent experience of operating the English Schools Council Integrated Science Project (SCISP). This project was chosen for study because it asked teachers to take seriously the discussion of value issues in science, in the context of integrated subject matter, with a aim of changing student attitudes and evaluating these changes. On the face of it, such a project was likely to require teachers to alter their practice significantly, and thus would likely be a suitable context for discussing the meaning teachers attach to aspects of their work. Teachers were asked to discuss how they viewed elements of the project, to describe what problems they encountered and to indicate how they resolved these problems. Students, administrators, project developers and supervisors were also interviewed as part of the research design.

It became clear that trying to implement the project created dilemmas for teachers. A dilemma arose when doctrinal commitments were at odds with those of the teacher, and it was in relation to these dilemmas that teachers were able to begin to articulate the meaning they attached to what they commonly did and

why the project doctrine was upsetting. Invariably, dilemmas were resolved in favour of common practice, although teachers would resolve them, when asked in interview, hypothetically in directions they thought I would favour. When asked to tell how the dilemma was resolved, the teachers tended to talk about how the dilemma might be resolved, and this was often in a direction opposite to how it actually was resolved.

The concept of a dilemma in curriculum is an important one in relation to understanding the effects of innovative doctrine on practice. I have developed this idea from the Berlak's (1975) use of dilemma to understand what they took to be inconsistencies in behaviour of supposedly informal English primary school teachers. There are a number of important differences in their use of the term and mine. In their case, a dilemma arose for them because teacher behaviour did not conform to doctrinal expectation; what went on was not always "informal" to put it very roughly. In my use of the term, a dilemma is what teachers experience because of a tension between personal and doctrinal commitments. So this is one important difference; whose dilemma is it? The second difference hinges on the first and is concerned with the level of analysis of the origins of dilemmas. The Berlaks invoke a theoretically derived analysis of opposing tendencies underlying the actions of teachers. They identify polarities associated with fundamental beliefs about the nature of learners, knowledge, culture and so on, and teacher behaviour is seen by them to reflect tendencies to resolve dilemmas

differently at different times. Westbury (1979) makes much the same point in saying that "A vast gulf appears to separate the work place of the school with their resources and tasks from the kinds of workplaces reformers would want" (p.152). His analysis of this divide is similar to that of the Berlaks.

There is no question that ultimately what people do in classrooms can be seen to be related to a variety of fundamental commitments with the kinds of polarities suggested. Where I would want to go further than this is to probe how such commitments work at the level of day to day work in the classroom; just what tensions do teachers perceive? In pursuing this, the purpose was to obtain an account of opposing tendencies in terms used by the teachers and close to the associated moves they make to resolve the dilemmas. In an attempt to probe behind the tensions that seemed to underlie what teachers told me were the problems associated with operating the project, I used a modification of a clinical interview strategy and instrument developed by George Kelly (1955). These provided a rich source of teacher comment in their language about their work which could be probed and subsequently analysed in a number of ways.

Such a strategy has been used by others (Duffy, 1977; Bussis, Chittenden and Amaral, 1976) interested in what has been called teacher implicit theories (Clark and Yinger, 1977). Later in the paper I outline the procedures used.

When asked to construe their work using the Kelly interview method, teachers seemed very concerned about one underlying tension that emerged from their use of the innovative project, and which acted as a root source of important dilemmas. This tension had to do with teachers' influence in the classroom. I should point out that the term influence is used here in the sense of a having an effect upon students. The project doctrine asked teachers to reduce their influence by suggesting free ranging discussion, by down-playing the importance of their subject and preparation for exams, and by asking teachers to teach outside of their discipline. The most fundamental loss of influence was associated with the project stress on the Gagné learning hierarchy, in relation to which, the teacher was expected to play midwife to the intellectual development of the student. This role was explained in unfamiliar terms and involved effects hard to assess. Teachers measured effects of instruction not through numbers of students achieving certain levels of problem solving skill, but through the accumulation of notebooks and through exam results. Teachers found the varied and extensive onslaught on their influence distressing, but difficult to articulate. They were aware that what they wanted to do was at odds with the project, old fashioned, mildly reprehensible; yet all they had to work with in order to accomplish what they saw to be the unchanged goal of getting students through external exams. As a consequence, a litany of project domestications occurred; discussion became lecture or recitation; intellectual

skill development became content memorization and exam rehearsal; integrated science became separate subjects, as far as possible; criterion referenced assessment became normed and so on. Teachers, I would argue, acted to establish their influence in spite of the strong project doctrine favouring the opposite. After a period of drift, teachers consolidated their position of influence through varied domestications of project doctrine which had committed teachers to exerting less influence in the classroom and promised growth of problem solving ability as a consequence. Teachers were committed to exerting a strong influence in the classroom at the expense of intellectual stimulation. Thus were dilemmas created.

This brings me to a final and perhaps fundamental source of dilemmas for teachers. Bryan Wilson (1962) has argued that teaching can be characterized by role diffuseness, and that one of the consequences of role diffuseness is conflict and uncertainty. He defines a diffuse role by contrasting it with a specific one. A specific role is one in which there is a strong connection between cause and effect, where there are clear boundaries to the task and to the commitments required of the players. The diffuse teaching role, I would say, is partly a consequence of a weak technology and a lack of delineated goals.

One of the reason why teaching is a diffuse activity is that it is difficult to tell whether anything has been accomplished. Teachers have to strive to identify evidence of accomplishment: the accumulation of notebooks, the one or two clear cut examples

of having an influence, the salient special cases. The nature of the descriptions of teacher job satisfaction that Jackson (1968) and Lortie (1975) give make sense when we realize just how difficult it is for a teacher to see that he/she is having an effect.

Wilson(I962) identified six consequences of role diffuseness in his article on the role of the teacher. An analysis of the SCISP teachers' comments in terms of these six consequences indicated that all of the teachers had experienced such consequences to some degree(Olson, I980). Experience of these consequences could be seen to have influenced the actions of teachers with respect to implementing the project doctrine. The teachers experienced problems stemming from low influence teaching in the following categories: task demarcation, diverse role expectations, marginal roles, lack of institutional support, conflicting career commitments and multiple gols of education.

The teachers' comments about these consequences of role diffuseness indicated a perception of considerable risk attached to adopting low influence methods. Such methods were seen to involve less reliance on: subject matter expertise, teacher authority, subject based organization of course content, and more on student opinion, discussion of value issues and teacher withdrawl into the background. The teachers' ideas about the form and function of low influence teaching were highly coloured by their experience with high influence methods.

We can now draw together a number of threads that have been discussed above. Put simply, the teachers were faced with a dilemma;

a choice between the project recommended methods of exerting influence and familiar ones. Whichever way the choice was made unsatisfactory consequencesoccured. If the former was chosen, the teacher risked increasing the diffuseness of her role; if the latter was chosen, the teacher risked failing to "succeed" with the project, not stimulating the students intellectually and perhaps not preparing them properly for what was perceived to be an exam based on "t. inking" ability. The dilemma of influence was central; all of the teachers talked about it,and no matter what the specific dilemma that was being discussed,the conversation turned to the topic of influence eventually.

The Dilemma of Influence: A Case Study of Teacher Perceptions

The central importance of influence to this argument urges a more detailed consideration of what teachers mean by influence and how this was found out. There is thus a substantive and a methodological aspect to this section of the paper. Through use of Kelly's (1955) clinical methods as adapted for this study, teachers were asked to construe various forms of science teaching, and it is out of this material that the idea of teacher influence was developed. This idea was used to understand both why certain dilemmas emerged for teachers as they used the innovative science project, and why they resolved them as they did. The functions of influence, as teachers saw them, help to explain why they domesticated the project doctrine the way they did and why they finally abandoned it.

In the discussion that follows, two forms of high influence teaching are described followed by an analysis of teacher

comments associated with low influence teaching. I will argue that teachers have difficulty in understanding just what low influence teaching means in practical terms, and that this comes about, not because such forms lack adequate instructions or require too much investment (Doyle and Ponder, 1977), but because teachers lack the experience of such forms; they do not know how to construe the point or method of using them. Thus the teachers I talked to did not know what it meant to promote problem solving behaviour in the classroom, or to teach by inquiry, or to have a discussion with students. I turn now to the procedures used to study the teachers' ideas about influence.

Research methodology The eight teachers involved in this study were science graduates working in three English comprehensive schools. All schools were using, or had recently used, the project materials and entered students for the project-based external exam. In each school the head of science and at least one other science teacher was interviewed along with peers, students and headmasters.

Each teacher was interviewed for a period of four hours on four occasions over a period of three months, during which time, the investigator was frequently in the schools for one reason or another. The last two interviews were devoted to construct elicitation and a probing interview based on how each teacher had completed the research instrument. Interviews were part of a larger research strategy making use of a variety of data sources and methods.

The construct interviews made use of a modified design based on the method originally used by Kelly (1955). First, five standard works in the field of teaching science, such as might be familiar to the science teachers, people planning their in-service work and advisors were selected. These were: Ministry of Education Pamphlet No. 38, Science in the Secondary Schools, 1960; J.K. Kerr, Practical Work in School Science, 1963; Association for Science Education, Teaching Science at the Secondary Stage, 1967; F.R. Jevons, The Teaching of Science, 1969 and Association for Science Education, The Teaching of Science in Secondary Schools, 1970.

These books were subjected to the following content analysis. Chapters clearly dealing with methods of teaching science were selected and the chapters were read so as to extract all statements recommending a particular teaching approach or rejecting or criticizing an approach. On the basis of an analysis of all the books, twenty different approaches were identified. Four science teachers enrolled in a year-long university in-service course were asked to read statements of these events and comment on their language and "realism". As a result of their comments some of the statements were altered to improve the clarity. None were considered to be "unreal". The twenty statements about ways of teaching science became the elements of the study. (See Table 1)

Kelly (1955) suggested a number of methods of eliciting constructs, amongst them are the triad and the full context

Table 1

Science Teaching Events Used as Elements

in Construct Elicitation

	Science Teaching Events
1.	Pupils are making notes during a lesson given by the teacher.
2.	At their seats pupils are doing problems.
3.	The teacher is asking the class how to control an experiment.
4.	The class is watching T.V.
5.	The teacher is asking pupils to offer hypotheses.
6.	The teacher is doing a demonstration while pupils make observations.
7.	In class some pupils are helping others who have had difficulty.
8.	The teacher is questioning pupils to guide them to a generalization.
9.	On a field trip to a pond pupils are collecting data.
10.	The teacher is acting as neutral chairman in a class discussion.
11.	The teacher is questioning the class on the homework.
12.	The teacher is putting examples of a relationship on the board for the pupils' notes.
13.	During a practical pupils are making observations.
14.	Three pupils are presenting a seminar.
15.	The teacher is pointing out the scientific principles of a model he is demonstrating.
16.	A group of pupils are gathering data from students on the sports field.
17.	Pupils are writing an essay at home.
18.	Pupils are making measurements to verify a law.
19.	A pupil who has had difficulty is using a programmed text.
20.	Pupils are supplying labels for a diagram.

approaches. Although the triad approach is commonly used, in this study the full context form was used in view of the kinds of elements that are involved, and to avoid the production of superficial constructs. If the respondent has not been involved in supplying elements for the kinds of situations offered by the investigator, then the respondent will not be sure just what sort of situations are to be construed and not wanting to "fail", may key on superficial aspects. This might be a serious source of problem in this research and is overcome, to some degree, by using the full context method.

Accordingly, it was decided to use the full context method of elicitation. All twenty events were presented to the respondent who was then asked to group them so that those events grouped together share something in common. That something in common they had in mind, eventually became verbalized as a construct. In this way a number of constructs were elicited.

Rather than have the teachers appraise the elements using a binary code, as in Kelly's method, it was decided to use a variation. To help overcome some of the problems that binary assessments give rise to when data are analyzed, a four point scale was used. Respondents first decided which pole of the construct applied and then they marked a square to indicate whether or not they thought the construct definitely applied or whether it only tended to apply. If they thought that the construct did not apply at all they could indicate this in another box.

In order to check the construct elicitation procedures, the four science students mentioned above were asked to go through the procedures. This they did without trouble

When each teacher came to the construct interview in the school, he/she already had met with the investigator on two separate occasions. In these earlier interviews the teacher's reaction to working with project materials had been discussed and various aspects of the history of the project in the school had been reviewed. Rapport had been established sufficient to make the request for a construct interview seem a reasonable extension of the discussions.

The construct interview, which was tape recorded, began with an explanation of the full context method and with a standard form of words about how to proceed. The person then proceeded with the sorting task and formed groupings of teaching events usually without further comment in about ten minutes. Afterwards began a free flowing discussion whose aim was to help the person verbalize the basis of the grouping. The discussion of each grouping resulted in a form of words which the person felt expressed the basis for assembling the grouping.

The form of words was placed on a grid in readiness for completion after the interview. As aids to verbalizing the bases of the groupings, people were asked to contrast the group

with an earlier group or to simply express the significance of some comment made about the group. The calling up of constructs rarely happened quickly, in the sense that the final form of words expressing the construct was arrived immediately.

The grid form thus consisted of ten pages. A page for each of the ten constructs with each page containing five spaces for the respondent to make an evaluation of each element in relation to each construct.

A final probing interview was scheduled during which each teacher discussed the way they had filled in the grid with the investigator. The investigator spent, on average, some 3½ to 4 hours with each teacher. Two of these were spent in relation to construct elicitation and analysis.

Each grid was analysed using principal components factor analysis with varimax solution. The data from the grid analysis are being used to study the relationship between constructs and groups of constructs (correlation analysis) and between elements (factor analysis). It is planned to use the analysis of this data in relation to the interpretation of the interview data. The interpretation of the grid data is not yet complete, but there are indications that the analysis of the interview data in terms of forms of teacher influence is supported. It is to an analysis of the interview data that I now turn.

The comments made by teachers about their constructs suggested that a considerable source of concern to them in discussion of their role in the classroom was related to influence. Teachers seemed to construe forms of teaching along a dimension of high to low teacher influence. The nature of this concern was probed in the follow-up interview, and out of this emerged a more detailed idea of how teachers construed influence. Constructs elicited from the teachers were organized according to which form of teaching the teacher was talking about. This resulted in an almost equal distribution of the some forty constructs into two categories. Forms of teacher-student interaction involving low teacher influence, although frequently discussed by the teachers, seemed to involve a quite different level of awareness, discrimination, and confidence than in high influence teaching.

High Influence Teaching Teachers distinguished two forms of high influence teaching which I have called "teacher as prime mover" and "teacher as navigator." Prime mover activities involved lecturing, note giving, seat work and other forms of transmitting and guaranteeing information, and creating attention and involvement. Teacher as navigator involved greater pupil participation, but with firm teacher control over the point and direction of the lesson, as in question-answer sequences, recitation and guided discovery. Teachers differed over how to construe laboratory and field work; some saw it as high influence teaching, others as low, thus comments associated with these forms of teaching occur in

discussion of both high influence and low influence teaching.

Acting as prime mover (see Table 2) was seen to serve a number of functions; the main one being that the teacher could ensure a common basis of information for subsequent examination. The transfer of information involved was said not to engage the student intellectually, but it did get across facts without which, it was argued, further more stimulating activity could not occur. The teachers emphasized that it was necessary to give notes and to lecture in spite of the drawbacks. The teachers construed the process as a necessary evil about which they expressed feelings of guilt, engendered perhaps by their expectation that I would not approve of such methods, being from the university and investigating a project which stressed high pupil influence.

Most teachers construed the process as providing a base upon which the students could operate and from which the teacher could shape a particular view of the material or, alternatively, students could interpret for themselves.

Positive appraisals involved such phrases as: fundamental, essential, have to have it, quick, economical, valid, necessary, productive.

Allied to the relatively emphatic positive appraisal of information transfer were comments suggesting that the teachers did not want it thought that this was all that they did, or that they didn't realize that there was limited intellectual challenge for the student. Information transfer was construed as: menial, not ideal, rote, hum-drum, the pupil as a sponge. Robert Young's

Table 2

Teacher as Prime Mover

Source	Construct	Summary of Teacher Comments
A.W.	Teacher dominant/ teacher passive	actually instructing, getting information into books, you have to have it
A.S.	Productive/ unproductive	it could be unproductive if they don't get the right answer, avoid wandering off
B.J.	Traditional/discovery	useful for exams, good practice
P.J.	Unsophisticated mental ability/sophisticated	routine, mechanical, reinforcement, rote, hum-drum
R.S.	Receiving information/ acting on information	sit down and listen method of putting over information
J.E.	Working closely to teacher instructions/ using information	basic activity, information is given, using information is the contrast
R.Y.	Menial/intellectual	repetitive, essential, unintellectual, you have to have it
A.S.	Teaching the class/ easy way out	conveying enthusiasm, creating interest, doing the teaching
B.J.	Economical/discovery	pupil is sponge, quick, useful for college, you may get 30 different accounts of what was said
R.Y.	Transfer of information/ intellectual activity	not ideal, fundamental, teacher does the work
J.E.	Teacher does the work/ pupils do the work	not ideal

menial construct captures the "love-hate" view of information transfer:

> Pupils sitting at their seats doing physics problems--that's menial, but it is essential .... Pupils supplying labels--you don't really need to understand what it's all about to label a spade a spade sort of thing. You can do that and be successful at it, but have no idea what's going on. It's menial in that sense, but it is essential.

One of the complaints about the approach was that the "teacher did all the work". The teachers, by saying this, recognized that they were not supposed to do all the work, yet it often proved to be productive for them,as they saw it,to do the work as the following comments suggest.

> It could be unproductive if they don't get the right answer. They could spend an hour and still not come up with any answer. What do you do then? Do you carry on until they do find the right answer? ... Why not have suggested it in the first place? (A.S.)

> Nothing wrong with it, mind you (lecturing). The pupils is a sponge. I would hope he (teacher) would stop talking and ask questions. It's quick. You can get over information probably quicker than taking them out in the field. The only danger I see in it is that you are likely to

get thirty different accounts of what was said. (B.J.)

Not only is high influence teaching productive, but more importantly perhaps, the teacher is able to use his personality. The teacher can give a personal twist to the information being delivered. Andrew Scott, for example, saw this as a central function of his teaching:

> The teacher is hopefully conveying enthusiasm and liking for the subject knowledge. Hopefully this (knowledge) would also be in their books. Taking down relevant notes which would be useful to them, in the sense of the impending exam. This is productive in the sense of, for the time spent, they will have precise information, from which to learn and gain knowledge. Productive in the sense of getting them through the exam. Since I consider that that's the essentiality of teaching (leading the class), then I consider it (giving notes) productive.

Teachers construed a number of teaching events in terms of their controlling the direction and point of the lesson while allowing students to participate (Table 3). What the lesson is all about is something predetermined by the teacher and functions as a source of criteria for determining the relevance of pupil responses and the aptness of teacher questions. I call this controlling activity the "teacher as navigator".

The following comments illustrate why the teachers thought that it was important that they navigate the lesson.

Table 3

Teacher as Navigator

Source	Construct	Summary of Teacher Comments
P.J.	Fount of wisdom/pupil's point of view	teachers' point of view, channelled through teacher, gets results
P.J.	Productive/waste of time (fount of wisdom)	can be dull, necessary, shouldn't be dominant
T.J.	Expert information source/ pupils gather their own information	teacher O.K.'s information, kids expect this
T.J.	Pupils guided by teacher/pupils on their own	teacher puts kids right if they are wrong
J.E.	Pupils thinking under teacher guidance/ pupils think on their own	important cog coaxing information from pupils
R.S.	Give and take with teacher/discovery	teacher sums it up, slants it to what it should be
J.E.	Advisor/lecturer	physiotherapist, puts right "ills",leads them to an appropriate answer
B.J.	Teacher controls outcomes/outcomes unpredictable	planned effect, artificial, deliberately designed, it will get the point over
A.W.	Predictable outcome/ unpredictable outcome	doing what they are told, looking things up in books, they cannot hope to break new ground each time

I would never like to have a class sort of hung up too high and dry (with their) going out of the room thinking, "Well, what on earth am I supposed to make of that one?". (T.J.)

I think the less able pupil relies on the teacher for guidance, for information. They tend to believe what the teacher says. They lose confidence if the teacher isn't leading them. (A.W.)

It (discussions) takes a lot of time. You could spend a whole period discussing something and the teacher could come in and say this is the case, write it down, next point .... It takes a lot of time and when you've got it all in, you haven't got a lot of information. (B.J.)

I see that this questioning as a bit more desirable at the lower ability range, well, the average. But the most able who are wishing to stay on, they need more facts. I think it's ideal that a pupil find out the answer for themself. But I think it's too long winded. (J.E.)

They've got to believe in what you are saying. If they think you are unsure of your facts, they switch off. Do they trust you are telling them the right things they need to know, and,

> in fact, is the stuff you are telling them factually correct? (A.S.)

These teachers took it as their task to ensure that the lesson had a valid point and that the students could trust the teacher to make sure that the class ended up with the right information and the correct ideas. Simultaneously, they had to ensure that the lesson did not go astray. The former might be called the "editoral" and the latter the "director" function. The following comments describe the editorial function with the key terms underlined.

> The teacher guides the discussion and puts them right if they are wrong. He takes out what isn't quite relevant. (T.J.)

> Now the teacher is a physiotherapist, putting right any of the ills. (J.E.)

> The bulk of the lesson would be independent of the teacher, it's their feelings, but the crunch of the lesson is summing up; (this) would be the teacher. (R.S.)

> The final arbiter of what is correct or incorrect is, I think, the teacher; unless someone else in the class knows the answer. I don't think kids naturally or automatically arrive at the right answer, and, of course, the information they want is perhaps outside the range of experience, and therefore the teacher is very essential, very necessary. (T.J.)

Trevor Johnson, above, placed considerable emphasis on the importance of his leadership. By being in charge he is able to assess the correctness of the facts transmitted, maintain involvement in the lesson, avoid wasting time, help the less able, make sure the point is made and gain satisfaction.

In the editorial function, the teacher lets the students have their say. He listens to what is said and assesses it in relation to factual accuracy and relevance to the point. It is the teacher's job to see that the point of the lesson is established. If the pupils on their own fail to get the point, then the teacher must step in. By acting as an editor, the teacher serves three related functions: students understand the material, they are assured that there is some point to understanding the material and they participate in a process which is designed to engage their attention.

Besides acting as editor the teacher steers the lesson to a desired end; a predictable outcome for the lesson. This is the director function.

Selection of materials was referred to as a way of direct- the lesson. . In Ann William's case, doing problems from a book or labelling a diagram had predictable outcomes because, through the materials, she controlled what pupils did. Such activities she saw as necessary and she contrasted them somewhat defensively with "breaking new ground every time"; a reference to the supposed discoveries of the discovery approach which she didn't see happening in her class.

Bryan Jenkins saw practical work and demonstrations as under

his control so that he could ensure that the intended points would be made: "If you are trying to get an important point over, you are going to choose an experiment which will show it. You don't choose something which might show it."

Robert Young regretted, perhaps for my benefit, that experimental work was so predictable: "In normal scientific investigation you can (for example) use the pipette only one way and in that way you are not giving them the choice to develop their own experiment."

The most common way of directing a lesson was to use a series of questions to alert students to the direction the lesson was meant to be going. By careful questioning, students could be made to discover the point. The following experts suggest how this works:

> He is taking it bit by bit to build a clear picture of the whole thing, so that each pupil in the class is contributing a small part. Bringing it out bit by bit, rather than diving in at the deep end and possibly obscuring some of the smaller points that build up to the overall hypothesis .... The pupils are having to memorize inferences, to use insight or imagination of their inferences to make further points, to draw the whole thing together. (R.S.)

> It's a form of guiding which you can give to kids. When the penny drops, hopefully, for the majority of them, for me that's gratifying. You have given them information and you have guided them to the conclusion you wanted. (A.S.)

> Essentially the teacher is trying to get them to form their own ideas independently of his, but he will make sure they end up with the right idea in the end. (T.J.)

> The very good teacher is the one that can control the discussion exactly along the lines he wants to go without the pupils realizing it, leading them right up to the point so that they themselves make a discovery. (B.J.)

What I have called high influence strategies have also been called "coping strategies." (Westbury, 1973). In what sense do they help teachers "cope"?

It might be the case that these highly teacher-influenced approaches give teachers a strong sense that they are doing the job. Rather than take at face value the teachers' lament that in such approaches they are doing too much of the work, we might look upon this as a statement of what the teacher actually does find satisfying. Being directly in contact with the student provides the teacher with a wide range of opportunity to influence what goes on, and not the least of the opportunities

that exist, is the sense of satisfaction that the teacher can derive from doing the work. Andrew Smith and Peter Judge allude to such satisfaction:

> I am teaching by giving information or by stimulating kids to extract information for themselves. Actually teaching the kids. I'm doing the teaching. (A.S.)

> I get the greatest satisfaction out of a good show, well presented .... (But in a seminar) I feel I feel I ought to be in control, but I hand it over to them and they make a mess of it. I'm not sure what I should do about it. (P.J.)

Eisner (1979) ends his essay on the art of teaching by suggesting that optimal conditions for student growth are not going to be met unless teachers find satisfaction in their work. It is just this requirement that seems to be operating in the teachers ideas about the functions of high influences teaching.

Low Influence Teaching Teachers' comments concerning low influence teaching, (Table 4) contrasted sharply with those associated with high influence teaching. Where teachers were clear about what they were trying to accomplish and how to go about it in the latter case, they were unclear about the effects of their teaching and their role in the former. Where they had been definite, realistic and evaluative in their comments, they became tentative, detached and unrealistic. All of these trends suggested that high and low influence teaching are construed in

Table 4

Teacher as Referee

Source	Construct Dimensions	Summary of Teacher Comments
R.S.	Active observation/ pupils passive	Collecting of information, a method of putting over information
A.S.	Pupils could get lost/ pupils guided	Grouping in the dark, boredom, time wasted
A.W.	Pupil enjoyment/routine	Variety, predicable out-come, provided satisfaction
B.J.	Pupil influence high/ teacher influence high	Learn how to tackle a problem, high pupil contribution
T.J.	Pupils share ideas/ pupils listen to teacher	Teacher is soliciting information Pupils learn from each other, Opportunity for expression
A.W.	Pupil-pupil reliance/ pupil-teacher reliance	Teacher in backgrcund, guiding hand, in backseat, think for themselves, be responsible
R.S.	Pupils independent/ pupils dependent	Gaining confidence in what they are doing
R.Y.	Pupil does the work/ teacher does the work	Preferable, form their own ideas, independent
T.J.	Pupils work on their own/pupils listen to teacher	Teacher not involved, use their own resources, learn to be self sufficient, trust judgement
P.J.	Synthesis of thought/ memorization	Richer association, complex, uses different styles of thought

Table 4

Source	Construct	Summary of Teacher Comments
J.E.	Pupils make reasoned judgement/ memorization	As they move up the school they can make reasoned judgements
R.S.	Pupils use insight/ note information	Interpret information, use previous notes, deduce what might happen
B.J.	Communicate ideas/ Listen to teacher	Helping to verbalize and defend ideas, going deeper, helping to argue
R.Y.	Stimulating/listen to teacher	Own progress, make own decisions, individual formulates own ideas
A.W.	Pupils transform information/take notes	Clarification and reorientation of ideas, clarify vague thoughts
A.S.	Divorces teacher/ unites teacher with class	Pupils feel you are not helping them
A.S.	Requires trust/ pupils independent	Pupils depend on teacher for correct facts

quite different ways by teachers and that they represent quite different forms of teaching. Low influence teaching involved the teacher acting as a discussion teacher, or organizing a student seminar, or field work, or setting essays on social issues topics. Two main themes can be found in the teachers' comments about low influence teaching. First, teachers found it difficult to construe the intellectual activity which they tended to associate with low teacher influence. Constructs about intellectual goals seemed vague and loosely related to what the teacher did. Secondly, teachers had difficulty in construing a meaningful role for themselves or their pupils in low influence teaching. Each of these points is discussed below.

Teachers talked about their pupils' thinking in connection with two types of constructs. In one type they construed an approach in terms of what intellectual skills it might foster. In another type, teachers construed the intellectual functioning of the pupil in trying to explain why a particular approach would or would not work. In both types of cases, the comments of the teachers constrasted sharply with comments associated with high teacher influence constructs, which focussed on moves made by the teacher. In talking about low influence situations, the teachers used words, whose meaning seemed vague, to describe what they thought pupils were doing with information that had been given to them. The following excerpts give some idea of the language used. Words that describe intellectual activity involving the

the pupil are underlined.

> They are having information fed to them and they are having to churn some information back out again. It has to undergo a wave length change. (A.W.)

> We then infer from the data. When the pupils are given or have the information, they are asked to deduce what might happen, what is what .... They have to have various ideas .... In putting labels (on a diagram) ... they are using previous notes and previous experiences and reasoning from them. (R.S.)

> I think many of them will never be good problem solvers because this involves the highest level of cognitive performance. (T.J.)

> Psychological strata are, ideally, all being brought into play here .... They must involve a variety of bringing together all of your different affective and cognitive styles of thought. (P.J.)

The teachers described the effects of their instruction with some tentativeness. Andrew Scott used the term "hopefully" a number of times to signal a statement about the effects of his instruction: hopefully his instruction was relevant, hopefully intellectually stimulating and hopefully interesting. Peter Judge used the term "ideally" to signal that what he was talking about didn't always occur. The detached style of the talk can

be seen in phrases like "sort of" of "what is what" of "your different affective and cognitive styles". Bryan Jenkins reverted to short, choppy sentences when talking about the effects of his instruction: " This group is getting the children to think. Getting them to produce ideas. Going deeper into them. Having to verbalize and defend their ideas. Helping to argue."

Comments about the effects of instruction on the pupils' thinking were either in everyday kinds of language like "reasoned judgements" or "powers of reasoning"; or in psychologically derived phrases like "insight" or "synthesis" or "affective"; or in phrases derived from science like "deduction" or "inference". Whatever the origin, they were all alike in seeming to be unrelated to any other matters teachers talked about. They seemed peripheral and submerged. A good example of the contrast between teacher talk about social relations in the classroom and the effects of instruction on pupils' thinking can be seen in the following extracts:

> (In discussion) low ability kids just usually aren't prepared to say anything, given the situation where they can say anything in an ordered way as opposed to making stupid comments throughout the lessons. (A.S.)

> Getting them to correlate the appropriate information (in essays) in a coherent way would be asking too much .... This is productive in the sense of, for the time spent, they will have precise information from which to learn and gain knowledge. (A.S.)

The picture of unruly "low ability" kids making stupid comments whenever they can get a word in edgewise is sharply drawn and imbued with concern. On the other hand, the effects of instruction (underlined) come across as vague and off-hand. It is hard to know what is going on in pupils' heads, and it is not surprising to find teachers vague about this. Yet they are expected to be able to say just what the effects of their instruction are. As well, curriculum materials will often assume that affecting how pupils think is something that teachers can do with ease.

In view of the expectation to be able to talk about what they do in terms of effects on children, such as would impress outsiders, teachers, in the absence of evidence to the contrary, appear to adopt the quite reasonable strategy of making extravagant claims about what they do. In this way they can put an acceptable face on what they do. The following comments give some sense of the teachers' claims:

> One of the SCISP people has got (an) attitude which makes me see red. When I'm telling them how to find the specific heat of something or other, he says, "Well if it's a known number, why dc we have to know how to find it?". My point of view is that we might be on the verge of a great discovery. (A.W.)

Richard Simpson describes what happens when he asks pupils questions:

> The pupils are having to memorize observations, memorize inferences, to use insight or imagination or their inferences to name further points, to draw

the whole thing together.

Trevor Johnson sees important outcomes when pupils do problems at this desk or write essays:

> Having to be self sufficient, learning to trust your own judgement as to how to put things down .... I think it's important for living. I would look at that as education through science.

These points are not made to berate teachers; it is not surprising that these teachers construe their work in grand terms. In the absence of a well understood connection between instructional moves and effects on pupils' thinking, teachers are left with the problem of explaining to others what they do in acceptable terms. By adopting important outcomes as goals of their work for public scrutiny, they manage to decrease the effects of the diffuse work they do. I would argue that the extravagant claims that are made are entirely functional in the context of management of role diffuseness associated with teaching as a job. Another important point to be made here, parantheti-cally, is that these teachers did not think about their work in means-ends terms as they are expected to do according to recent curricular prescriptions for their behaviour, and more especially as the doctrine of the project expected them to do.

The other main theme running through the teachers comments about low influence teaching concerned teacher-student roles. The teachers found it difficult to understand how they should behave and how to construe their students' behaviour, and because

of an apparent lack of experience, the teachers tended to think of low influence teaching approaches as if they were variants of more familiar forms. The following series of comments indicate the nature of the dilemmas teachers faced in relation to low influence teaching.

> It's quite foreign to a lot of science teachers (being a neutral chairman). They deal with a lot of facts and here we are asking for discussions which could be very open-ended .... It's very difficult to manage (a discussion) with some of them absent or some have the facts and some don't .... Then you've got pupils at different levels of maturity to discuss something. Whereas some can and they might be mature enough to put forward certain views, but not in a mature manner, laughing about it, giving some stupid sort of view .... I can remember the one (SCISP investigation) which I didn't feel I could mark or give any sort of written work in books, about the population problem and food. The question was what to do about it, and they came back, "Well, kill off anybody over the age of 32!". Who am I to say that is wrong? .... This (seminar) is difficult to manage, I think, because the pupils haven't got the facts. They are very loath to get up and speak in front of others and it is usually the extroverts who have got unusual ideas, which are probably wrong anyway, so this is why it becomes difficult to manage. (J.E.)

Robert Young had difficulty construing what a discussion was. To him a discussion has a predetermined point and pupil comments are interruptions:

> This is something that came up in SCISP that I found great difficulty with. (Discussions were) very difficult to do. This sort of area comes up in a course we call Humanities where this sort of thing would be discussed at length. If the teacher isn't competent and skilled at extracting conversation from kids, or if he isn't able to provide the correct stimulus to get the discussion started, and if the conversation doesn't go quite the way it was anticipated, then this is the difficulty with it. It's an attitude to teaching. If you are prepared to accept their comments as you are going through, even during demonstrations and if you are prepared to answer their questions although not directly related, then it's a fairly easy step to go to something like this.

Richard Simpson considers discussions as bordering on the chaotic:

> The teacher is acting as a referee, just keeping order. He's not even acting as a guide, guiding the discussion in a particular line. He's letting it go under its own inertia. To me it's almost a free-for-all situation. The teacher is there to make sure that it doesn't get out of hand ....

> The (discussion) depends on the skill of the teacher. I think you can do it on a small basis, but not on a full class basis. This is a topic I think I could deal with in a "buzz" group.

Peter Judge did not see how the teacher could act as a neutral chairman and have a useful lesson, given the attributes of his pupils. Like the other teachers, he found the lack of control frustrating, particularly in the fact that many pupils do not participate as a consequence.

> When I have tried to play neutral chairman, it's a pretty lousy description of the role. You are as much a manipulator as in guided discovery. It might be possible, but I haven't experienced this myself. (Rather) it's the deliberate management of ideas inculcating your particular picture of these ideas by a variety of devices. (I am) an information source and a source of structure .... It's very difficult to get genuine synthesis of thought. My neutral chairman debates have tended to be the student stating fixed positions; there being a clash of opinions. You just get contrasting and opposing, not synthesizing. You can open your mouth and dribble away. (Anyway) the majority in your neutral chairman debate are (not going to talk), but in the essay, everyone is forced to put something down. By the fifth (form), a typical group, I'd say were getting a third of the group capable of fairly

good involvement. I wouldn't put it much higher than that.

What do these comments tell us about how teachers construe their role in low influence teaching? It is evident that the teachers tend to contrast such teaching with that where they are in charge and able to act in familiar ways. In other words, the familiar role becomes a basis for describing and evaluating the low influence situations. These situations tend to be construed in terms of the extent of teacher withdrawal from a central role. Images of retreat and withdrawal, or abdication of the teacher role entirely (technician, librarian) are used. The following list captures the way teachers construed their "retreat".

The teacher doesn't seem involved. (T.J.)

The teacher is just a controlling person in the background, if necessary .... The teacher is a guiding hand. (A.W.)

I'm likely to be hovering, guiding, inspiring, ticking off .... I really don't know how to handle that role (neutral chairman). (P.J.)

If the teacher does stay as technician-librarian, in other words, there's the resource, get on with it . . (A.S.)

The teacher is acting as an observer. (A.S.)

The teacher is to some extent merely a technician. (R.Y.)

The teacher is acting as a referee. (R.S.)

The teacher has disappeared further into the background. (J.E.)

The sense of withdrawal comes through clearly and words like "merely", or "just" suggest a negative appraisal of the role. The term "technician" is probably used to suggest something less than a professional role for the teacher. The teacher is cast as a referee in a game whose purpose and rules are unclear. It is hard to see how such a position could be acceptable to teachers. The teachers tended to appraise low influence situations by reference to more familiar roles. They tended to see these situations as non-functional variants of teacher dominated ones and to have assumed that low and high influence teaching both serve common goals. For example, discovery, practical work and discussion were criticized for not being as efficient as more directed forms of teaching. Here the teachers assumed that the more "open" methods were aimed at information transfer and interpretation; that is, they assumed a conformity of goals for all methods. The comments suggest that teachers did not seem able to construe the nature of a discussion as it might function in a classroom, and they did not seem able to construe the kinds of social relationships called for in a discussion or, more generally, in situations where teacher influence might be low. They did not seem able to construe an

effective role for themselves, nor for the pupils. Their phrases used suggest an imprecise and vague grasp of the role. For example, "controlling person", "observer", "referee". The sense conveyed is that the teacher has withdrawn in perplexity. Compared to their comments in relation to high influence teaching, teachers made fewer distinctions and seemed more clear about what ought not to happen than what might happen in a beneficial way.

Teachers are aware that science education theorists and modern science curriculum projects like SCISP expect them to use methods which involve high pupil influence. Yet the methods expoused by such projects are rejected by teachers, or, more importantly, teachers do not appear to construe these approaches effectively, and thus important parts of innovative doctrine are not implemented. This is what happened with SCISP. Teachers failed to construe significant aspects of SCISP goals and intended pupil-teacher relationships. The important point isn't that the teachers rejected the SCISP doctrine; it is that they failed to construe significant portions of it in terms of classroom roles for themselves or their pupils.

The teachers' descriptions of their teaching in relation to the expectations of project doctrine clearly show how the intersection of innovative doctrine and common practice generates dilemmas. The doctrine promises intellectual development for students, yet the methods recommended for accomplishing this require the teacher to cope with increased role diffuseness. Teachers realize they are expected to use less direct methods if they are to "succeed" in

implementing the project, yet they cannot see how that success is to be evidenced in terms they can understand; thus they persevere with "the old way" and risk the opprobrium of those who urge the "new way." Fortunately for them, those who do urge the "new way" often lack the power to press for it.

Conclusion

At this point it is appropriate to summarize what might be called teachers' theories of influence. Their influence, as they see it, seems to be directed not towards what happens in their students' heads, but to what happens in their direct encounters with students and the effects on the class of their actions. As Peter Judge put it, they seek a "Good show, well presented". A sense of influence is based on being able to provide the stimulus and expert guidance and the guaranteed information to help students obtain the credentials they expect to gain. The teacher authenticates what is transacted and guarantees it. Sources of influence, as the teachers see it, seem not to be based on an understanding of psychological principles, nor on the structure of their discipline, but on their ability to convince the students that what is happening is well produced and directed. The teacher as navigator role seems to function to balance the competing demands made upon teachers by the nature of school goals, the kinds of social relationships possible in classrooms and the limitations of technique.

As the teachers I talked to saw it, being a teacher was like being a mountain guide; someone hired because he knew the way to the summit and how not to fall. Such a guide adopts direct methods and is linked directly to those who follow. The relationship between the mountain guide

and climbers simply doesn't involve low influence climbing methods; they are hazardous, for one thing, and time consuming.

The analysis of the teachers implicit theories of influence indicates that teachers use high influence teaching not only to keep students at their work and their behaviour within acceptable bounds, but also to obtain for themselves a sense that something is being accomplished; that work is being done. The evidence they seek to confirm this does not seem to come from what the pupil attains, it comes from what the teacher does in relation to the pupils and how they react in the interactive situation. In discussing middle range theories of instruction, and the importance of attending to the influence structure of the classroom, Schlechty (1976) quotes Phil ip Jackson on the matter of the teachers primary and ultimate concerns. Jackson notes "Teachers, particularly in the lower grades seem to more activity-oriented than learning-oriented" (p. 24). Jackson argues that teachers do not give a lot of thought to the precise outcomes of instruction, rather they select activities which they think will be good for their students. I would add that the teachers I studied selected activities, in the sense of teaching approaches, that were good for themselves; that is, approaches which permitted the teacher to exercise influence over the work of the class in a direct manner and with tangible effects.

Teachers, of course, are influenced by the expectations of parents, principals, peers and students. They are expected to be influential in quite direct ways and they are expected to help students pursue instrumental goals. By acting as energizer,

editor and guide the teacher is able to adopt a relatively clear-cut approach to meeting these expectations. On the other hand, low influence teaching, involving situations like being a chairman of a discussion, or sitting back during student seminars, or marking essays on social issues, is a much less clear-cut way for a science teacher to exercise influence. The goals and rules of the game are not at all clear. The teacher asks "What is the use of my subject matter expertise and my ability to interpret it?". The teachers I talked to used the goals and rules they knew to reconstruct the new game into an inefficient version of the old, and eventually, tiring of the uncertainty about moves for which the rules seemed unclear or didn't fit, they abandoned the project. The low influence teaching that the project promoted didn't make sense.

The teachers were expected to prepare their students to write external exams; they were expected to lead in that direction, to make a difference. The teachers agreed that operating the exam system was a major goal of their work. The way they construed influence supported that goal and at the same time simplified their task. In thinking of their role as energizer, editor and guide, what Francis Stevens , in the National Science Foundation Case Studies in Science Education (NSF, I978). "pedagogical authoritarianism", the teachers were able to bring into a stable relationship their teaching goals, how others expected them to behave and the techniques they had. As Stevens notes "A disciplinary curriculum and authoritarian teaching are

... easiest for everybody" (p. 16:6). Her argument in detail for this idea is similar to my point that such teaching balances conflicting demands upon teachers in manageable ways. (See Reid 1979, for a discussion of the influence of organizational factors on curriculum change.)

The authors of Case Studies in Science Education (NSF, 1978), in their chapter on the teacher in the classroom, report similar teacher perceptions of tension between idealized forms of science teaching and what teachers actually do. They account for the failure of science teachers to use inquiry methods by suggesting that teachers are unwilling to risk situations where they may not know the answer and they suggest that teachers lack experience in dealing with the questions of thoughtful students on doubtful topics.

Another reason given by the NSF team for the persistance of what I call high influence teaching is that teachers are concerned about the goal of socialization. They identify two forms of socialization; that controlled by the subject and that by the expectations of the community. Their treatment of the socialization goal is not systematic, but it seems that their description might be reduced to the idea that teachers pursue what House (1974) calls managerial goals; getting students ready for the next grade and eventually a career. Teacher influence based on subject expertise and direct methods of teaching support the achievement of managerial goals and thus meet the expectations of others. The explanation for the stress on this goal given by the NSF team is that it provides the teachers mile-stones to measure

progress; what needs to be covered, what remains to be accomplished is kept clearly before all concerned. This I believe, can be interpreted in terms of teacher influence as a means of dealing with the diffuseness of teaching. Teachers seek to establish in their work, ways of assuring themselves and others that work is being done, and the search for milestones is part of that process. To change the metaphor, I would say that teachers develop relatively clear-cut systems of monitoring and measuring progress and obtaining reflections of their influence. By disturbing these meters of progress and the mirrors which reflect influence, the curriculum project I studied make the likelihood of its doctrine taking root remote. Such a doctrine did not comprehend complex, stable school systems and failed to appreciate the subtle interconnections between goals, expectations and techniques which were protected by teachers, students, parents and peers at the expense of the innovative doctrine. It would seem to be the case that as long as teaching involves a diffuse role for the teacher, innovations which increase the diffuseness of the role are going to make little impact. Perhaps a direct approach to teachers about handling the effects of role diffuseness might be more productive in bringing about new forms of relationships in the classroom.

Note

1. I owe thanks to William Reid for drawing my attention to the work of the Berlak's on dilemmas faced by teachers. Needless to say the outcome is entirely my responsibility.

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